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Exsic. no. 261, Plate IV. Fig. 6. was also sent me from Mount Washington by G. K. Merrill. This form is little known even in Europe, and is not regarded worthy of varietal rank, Tuckerman doubtless knew of it, for he speaks of the squamules sometimes occurring in the present variety. We figure the form *laontera* as well as the usual expression of the variety. The variety is known in all the grand divisions except Australia, commonly in mountains.

The various forms of *Cladonia gracilis* commonly occur on earth, on horizontal rocks covered with a small amount of humus, or on rotting wood. The plants are usually found in forests, preferring shade, and are often among mosses. The last variety descends to the tundras in northern regions and there often occurs in sunny and windy places. Grinnell, Iowa.

PHAENOLOGICAL OBSERVATIONS ON MOSSES.

H. WILHELM ARNELL.

In the BRYOLOGIST there appeared, in the year 1904, p. 35-36, a note on "The Fruiting Season of the Hair-cap Moss," by Phebe M. Towle and Anna E. Gilbert, that interested me much as it touched upon a subject which I myself have studied. A rather long time ago I studied the seasons of blooming and fruiting of the Scandinavian mosses (*musci veri*). The results of my researches were summed up in a paper, "De Scandinaviska Löfmos-sornas Kalendarium (Upsala Universitets Arsbkrift, 1875) in which the seasons of blooming and fruiting of all Scandinavian mosses known at that time were indicated as accurately as the material that was accessible permitted me to solve these questions. Since that time there has, as far as I know, nothing been published on the phaenological relations of the mosses till the paper of A. Grimme, "Ueber die Blüthezeit Deutscher Laubmoose und die Entwicklung ihrer Sporogone" appeared in Hedwigia, 1903.

I will now tell the results to which I have come with regard to the Hair-cap mosses. The species of *Polytrichum*, I found phaenologically to constitute two different groups. The species belonging to *Ymnitrichum* (Neck) Lindb., namely *P. urnigerum*, *P. nanum* and *P. subrotundum*, bloom at an early season at Upsala, in May or the first week of June, and the lids of the sporogones are therefore cast in the winter or early spring, at Upsala in December to April. These mosses thus require less than a year or seven to ten months for the development of their sporophytes. The majority of the Scandinavian *Polytricha*, the sections *Pterygodon* Lindb. and *Euleiodon* Lindb., bloom early in the summer, at Upsala in June and July, while the sporogones become ripe in July or the first days of August. These species require more than a year or about thirteen months for the development of their fruits. The two species of *Polytrichum*, *P. juniperinum* and *P. commune*, observed by the Misses Towle and Gilbert, both belong to the latter group of Hair-cap mosses. A comparison of their dates with mine shows a rather great difference, as according to the observations in Vermont, these mosses bloom in April, and the maturing of the spores takes place in August of the

following year, which difference probably depends on the different latitudes in which the observations are made. If the Vermont dates are correct, which fact I have no reason to doubt, *P. commune* and *P. juniperinum* in this region require fifteen to sixteen months for the development of their sporophytes.

The interest in the phaenological relations of mosses, of which the note in THE BRYOLOGIST bears evidence, encourages me to renew in a modified form a proposal of phaenological observations on mosses that I made in 1878, in the "Revue Bryologique," which proposal, however, has hitherto led to no results. In phanerogams the phaenological observations are, as is well known, always continued through as long a period of years as possible in order to get fully comparable medium dates in which the variations of single years are eliminated. Desirable as such medium dates may be in mosses, I do not however, dare to insist upon the carrying on of observations through a period of years in each place, because most bryologists will shrink from undertaking so toilsome a task. Dates from even a single year will be of great value and will open the possibility of interesting comparisons of the phaenological differences of mosses in different regions,

As it is the *beginning* of the blooming and the fructification that have been made the object of phaenological observations in phanerogams, I propose that the same phenomena be observed also in mosses. The beginning of the blooming in mosses is to be considered to occur when one or two archegonia only, in at least two flowers of a species, are opened, while the other archegonia are still closed and uncolored, or, if archegonia are not accessible, when only one or two antheridia in at least two flowers are opened and uncolored or brown, while all the other antheridia are still closed. In determining the blooming time however, if archegonia are at hand, these ought in the first place to be consulted, because we are less subjected to errors when determining the blooming time of a moss by the archegonia than when judging by the antheridia. Especially I warn observers against believing the blooming to have begun in a moss merely because its antheridia appear fully developed, if at the same time no antheridium is opened, as antheridia may often appear fully developed many months before they open and their antherozoides begin to swarm. In getting the date of the first blooming of a moss I have found it the least labor to collect specimens of the species that I desire to examine at different times of the year, for instance every fortnight, and then afterwards to examine all the collected specimens at once.

The fructification is according to my proposal considered to have begun when in a species about five to ten lids are naturally detached from their fruits; in dried specimens the lids are, as every bryologist knows, detached earlier than in nature, on which account dried specimens are less adapted for these researches.

My proposal was limited to only a small number of species. In making the choice of species I tried to get mosses that have a wide distribution, are easily recognized, have a limited season of blooming and fruiting and, as far

as possible, represent every different part of the year, etc. I will now enumerate the mosses chosen by me for observation on account of one or another of the reasons mentioned. To this enumeration I have added the results to which I myself have come in the midst of Sweden, at Hornoessand, 62° 30'

	HERNOESAND, SWEDEN			GERMANY		
	Bloom	Fruits	Devel.	Bloom	Fruits	Devel.
*1. <i>Acrocladium cuspidatum</i> (L.) Lindb.	15. VIII.	7. VII.	11	VIII.	VI.	10
2. <i>Amblystegium cordifolium</i> (Hedw.) DeN.	15. VIII.	7. VII.	11	VII. VIII.	VI. VII.	10-12
3. <i>Anisothecium rubrum</i> (Huds.) Lindb.	20. VI.	10. V.	11
4. <i>Astrophyllum punctatum</i> (L.) Lindb.	20. VI.	1. VI.	11	IV. V.	IV. VI.	11-14
5. <i>Astrophyllum silvaticum</i> (Lindb.) Lindb.	1. VII.	20. VI.	11	III. VI.	IV. V.	10-14
<i>Barbula unguiculata</i> (Huds.) Hedw.	1. VII.	1. V.	10	VII. VIII.	III. IV.	7- 9
<i>Bartramia pomiformis</i> (L.) Hedw.	15. VII.	1. VII.	11½	V.	V.	12
<i>Catharinea undulata</i> (L.) W. & M.	1. VII.	1. V.	10	V.	II. III.	9-10
<i>Ceratodon purpureus</i> (L.) Brid.	7. VII.	1. VII.	12	VII. VIII.	V. VI.	9-11
<i>Dicranella cerviculata</i> (Hedw.) Schimp.	1. IX.	1. V.	20	IX.	IX.	12
<i>Dicranum fuscescens</i> Turn.	25. VII.	15. X.	15	V.	VIII.	15
" <i>undulatum</i> Ehrh.	25. VII.	15. X.	15	VI. VII.	X.	15-16
<i>Funaria hygrometrica</i> (L.) Sibth.	1. IX.	1. VIII.	11	X.	VII. X.	9-12
<i>Georgia pellucida</i> (L.) Rab.	10. VI.	15. VII.	13	V.	V. VI.	12-13
<i>Grimmia apocarpa</i> (L.) Hedw.	7. VII.	20. V.	10½	V.	III. IV.	10-11
6. <i>Hedwigia albicans</i> (Web.) Lindb.	7. VII.	10. V.	10	VI. VII.	VI.	11-12
7. <i>Hylocomium parietinum</i> (L.) Lindb.	7. VII.	10. V.	10	V.	II. III.	9-10
" <i>proliferum</i> (L.) Lindb.	15. VII.	10. VI.	11	V. VI.	IV. V.	10-12
" <i>triquetrum</i> (L.) B. & S.	7. VII.	10. V.	10	V.	III. IV.	10-11
8. <i>Hypnum plumosum</i> Huds.	5. VIII.	10. V.	9
" <i>strigosum</i> Hoffm.	25. V.	20. V.	12	VII.	III.	9
<i>Philonotis fontana</i> (L.) Brid.	1. VIII.	15. VII.	11½	V. VI.	V.	11-12
<i>Plagiothecium denticulatum</i> (L.) B. & S.	1. IX.	1. IX.	12	VII. VIII.	VII.	11-12
9. <i>Pohlia cruda</i> (L.) Lindb.	1. VII.	15. VII.	12½	IV.	V.	13
<i>Polytrichum commune</i> (L.)	1. VII.	1. VIII.	13	V. VI.	VII. VIII.	13-15
" <i>pilosum</i> Neck.	1. VII.	15. VII.	12½	IV. V.	VI. VII.	13-15
<i>Ptilium crista-castrensis</i> (L.) DeN.	15. VIII.	1. V.	20
10. <i>Sphaerocapthalus palustris</i> (L.) Lindb.	20. VI.	25. VII.	13	V.	VI.	13
11. <i>Sterodon cupressiforme</i> (L.) Brid.	10. VI.	10. V.	11	IV. V.	I. III.	8-11
12. " <i>incurvatus</i> (Schr.) Mitt.	5. VIII.	1. VIII.	12	VII. VIII.	VII.	11-12
13. " <i>polyanthos</i> (Schreb.) Mitt.	10. VI.	10. V.	11	VIII. XI.	II. III.	15-19
<i>Tortula ruralis</i> (L.) Ehrh.	25. VII.	7. VII.	11½	IV. V.	V. VI.	12-14
14. " <i>truncatula</i> (L.) Lindb.	25. VII.	1. V.	9	VI. VII.	I. II.	6- 8

* Note. Current synonyms of the above mentioned mosses are: 1. *Hypnum cuspidatum*, 2. *Hypnum cordifolium*, 3. *Dicranella varia*, 4. *Mnium punctatum*, 5. *Mnium cuspidatum*, 6. *Hedwigia ciliata*, 7. *Hypnum Schreberi*, 8. *Brachythecium salebrosum*, 9. *Weberia cruda*, 10. *Aulaconnium palustre*, 11. *Hypnum cupressiforme*, 12. *Hypnum incurvatum*, 13. *Polytrichum polyantha*, 14. *Pottia truncatula*.

N. Lat., and A. Grimme, in Germany, with regard to the seasons of the blooming (Bloom.) and the maturation of the fruits (Fruits.) of mosses in question, as also with regard to the time (expressed by the number of months) which these mosses require for the development of their fruits (Devel). The days are expressed by the usual figures, the months by Roman numerals, as I (January), II (February), etc.

From the above table it will be seen that the results to which Grimme and I have come are similar, if the differences due to latitude are considered. With regard to two mosses, *Dicranella cerviculata* and *Stereodon polyanthos*, our results show greater difference; according to my experience in Sweden, *Dicranella cerviculata* requires about twenty months and *Stereodon polyanthos* eleven months for the development of the sporophytes, while these mosses require in Germany, according to Grimme, the former species only twelve months and the latter species fifteen to nineteen months for the same purpose. The dates contained in the table afford material for many interesting comparisons, and I hope they will induce some readers of THE BRYOLOGIST to examine the phaenological relations of the same mosses in their locality and by publishing the result procure more material for comparison.

Upsala, Sweden.

NOTES ON THE FRUITING SEASON OF CATHARINEA.

PHEBE M. TOWLE,

During the season of 1903 some attention was given to the fruiting season of the Hair-cap moss, and the report was published in THE BRYOLOGIST of March, 1904.

Observations for the sake of verification were repeated on the Hair-caps in 1904, with the same conclusions as were noted for 1903.

This same line of observations was followed during the season of 1904 with reference to *Catharinea undulata*.

This Catharinea is abundant about Burlington. The stations visited were in the ravine north of Colchester avenue and along the brook which runs through the woods of Fair Holt. Another station was along the bank of the Missisquoi River.

On the first trip afield, the last of March, Catharinea was found with the capsules shedding their spores freely when disturbed. This continued through April, the spores coming out in clouds.

On April 20th Catharinea rosettes were conspicuous. The antheridia were green in color, but had a narrow, clear space at the top. None of them were ready to shed their contents.

May 3d, Catharinea tufts contained archegonia of different heights but none were open.

May 7th, the antheridia were discharging sperm mother-cells, and three of the five archegonia of a female plant were open. There were five archegonia in each of the Catharinea tufts examined. When the archegonia were open they presented a well spread border around the top of the tube.